Thermal Analysis of DAEδALUS Target

Tess E. Smidt

Purpose of Thermal Analysis

- Minimize cooling costs
- Verify target design put forth by Chris Tschälar
- Investigate beneficial modifications to design

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Industry standard – ANSYS,

but for now, home-brew.

Home-brew Thermal Analysis Code

- ROOT Macro, Finite Element Analysis
- Integrates MARS geometry and energy deposition histogram
- Simulates beam and duty-cycle

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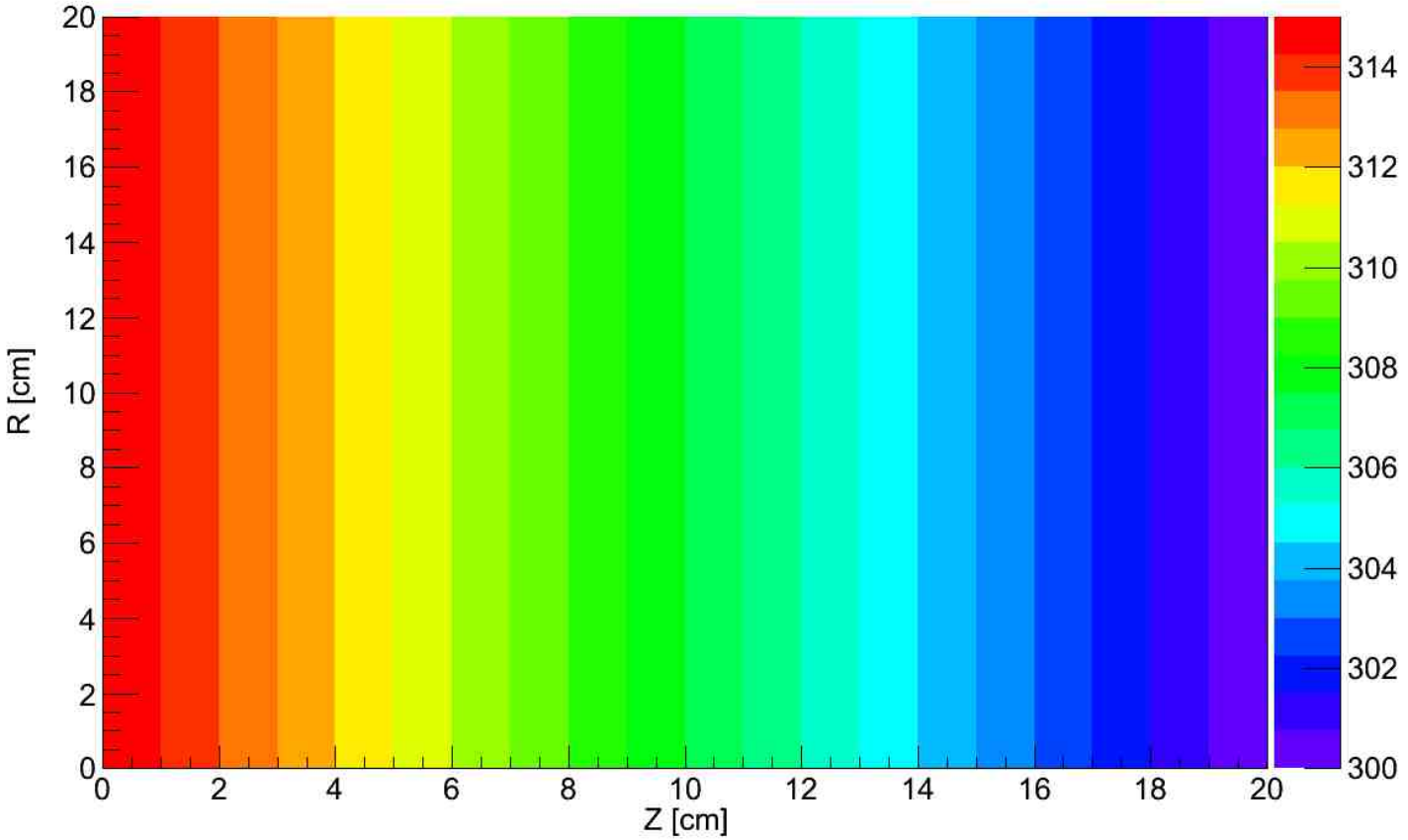
1. Deposit beam energy into each bin
2. Evaluate temperature change.
3. Transfer heat to neighboring bins.
4. Re-evaluate temperature.
5. Repeat…

Benchmarking Code

- Linear Temperature gradient between two heat baths



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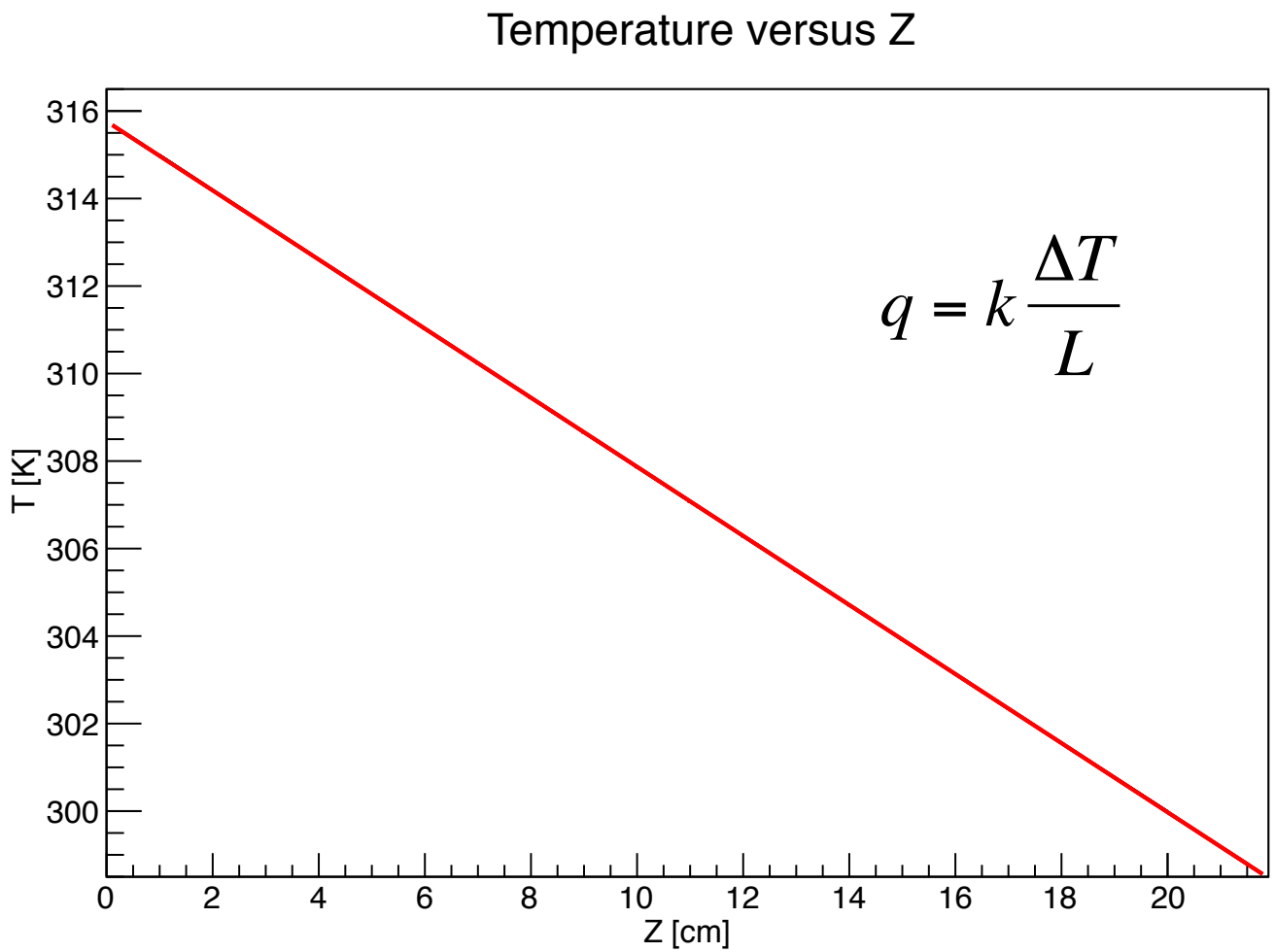
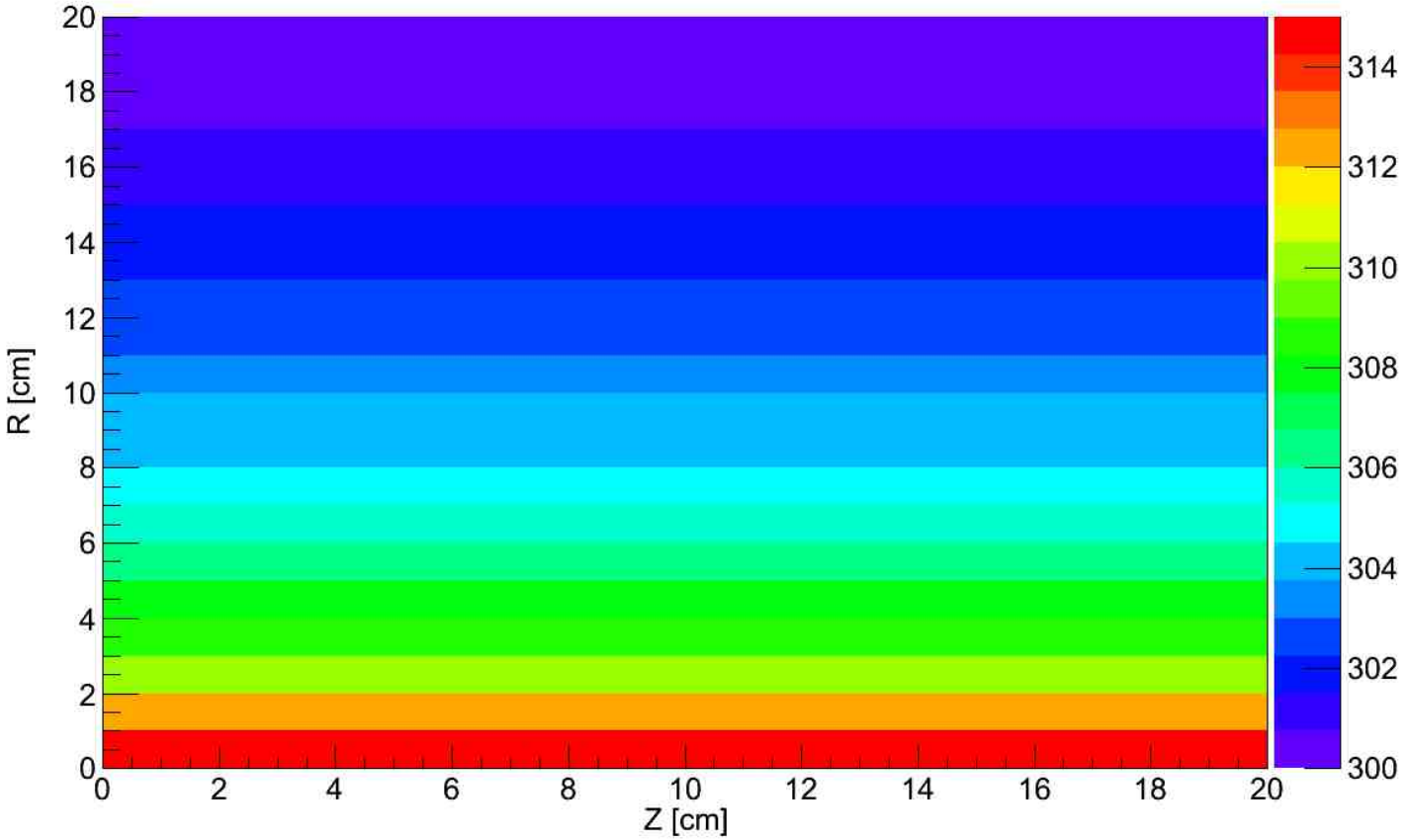


Benchmarking Code

- Radial temperature gradient between two heat baths



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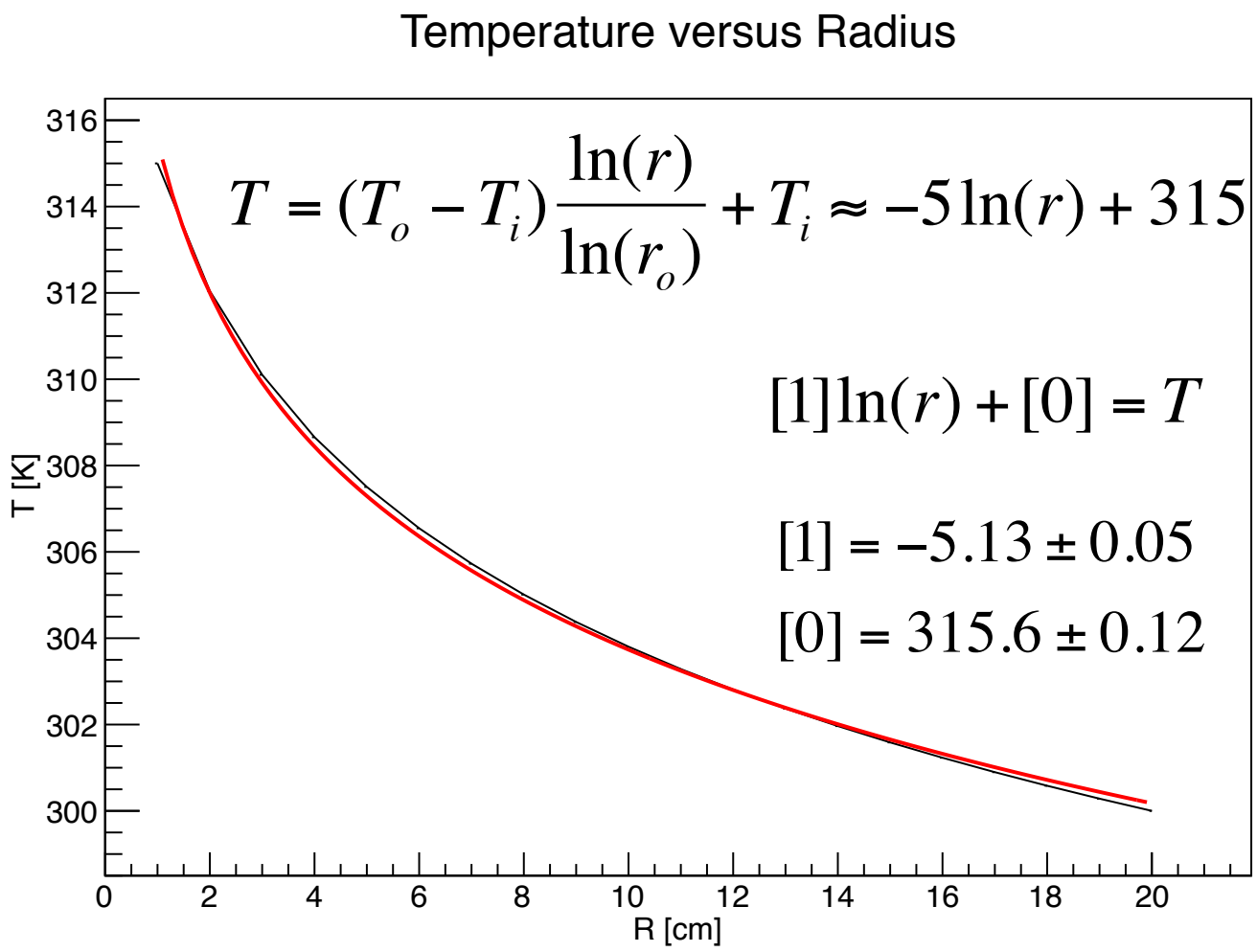
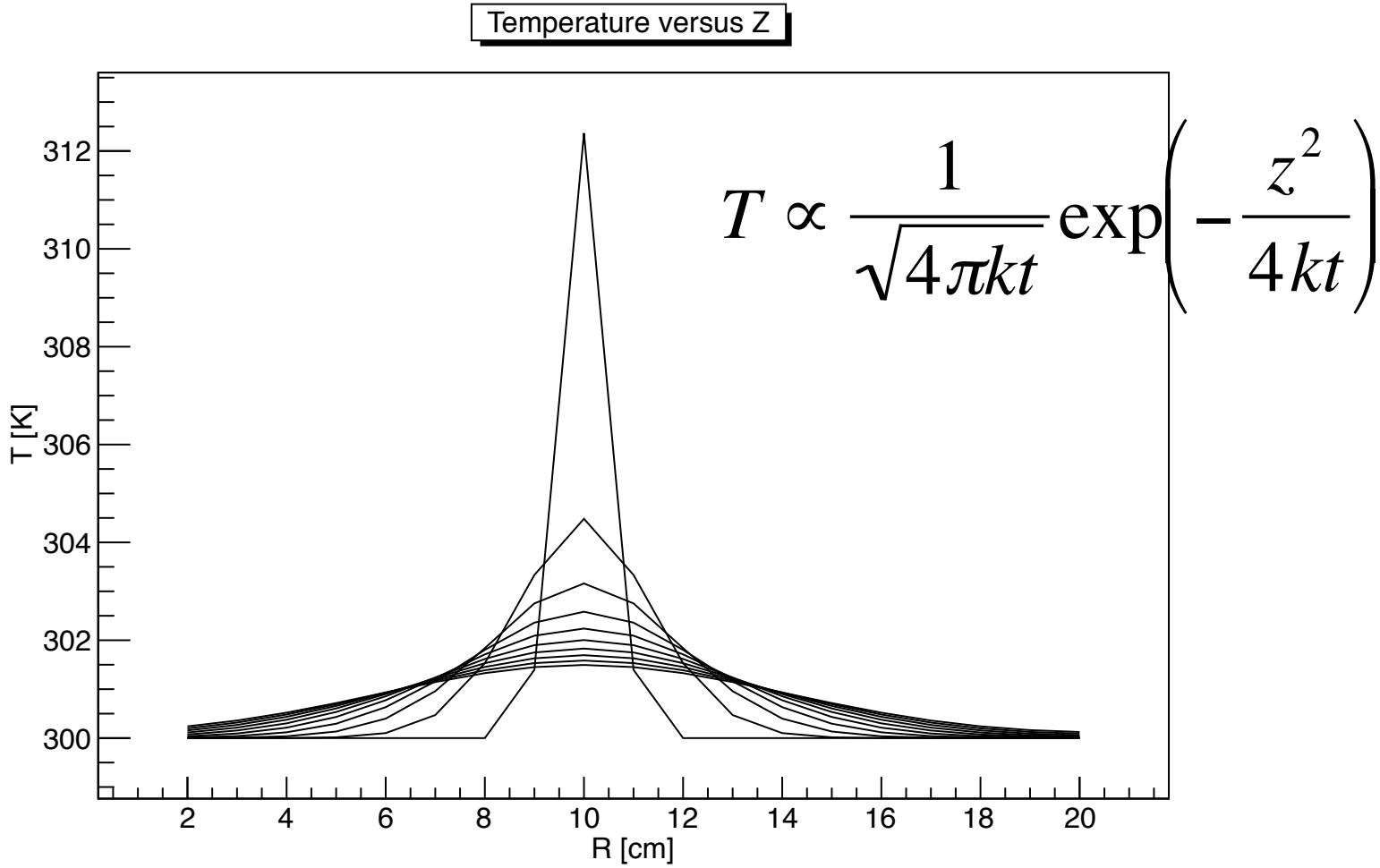


Benchmarking Code

- Diffusion of Gaussian temperature distribution.



$$T \propto \frac{1}{\sqrt{4\pi kt}} \exp\left(-\frac{z^2}{4kt}\right)$$

Benchmarking Code

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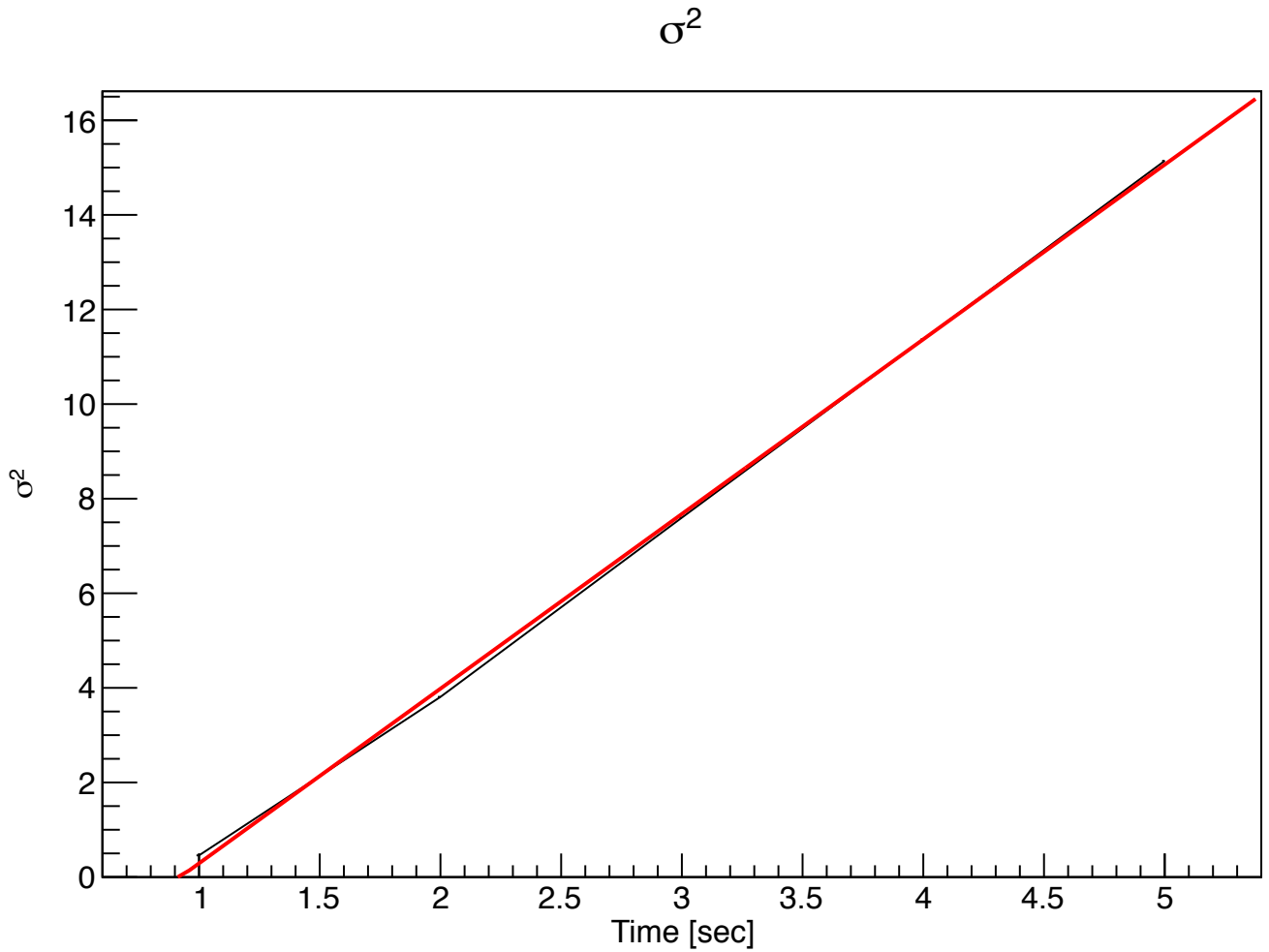
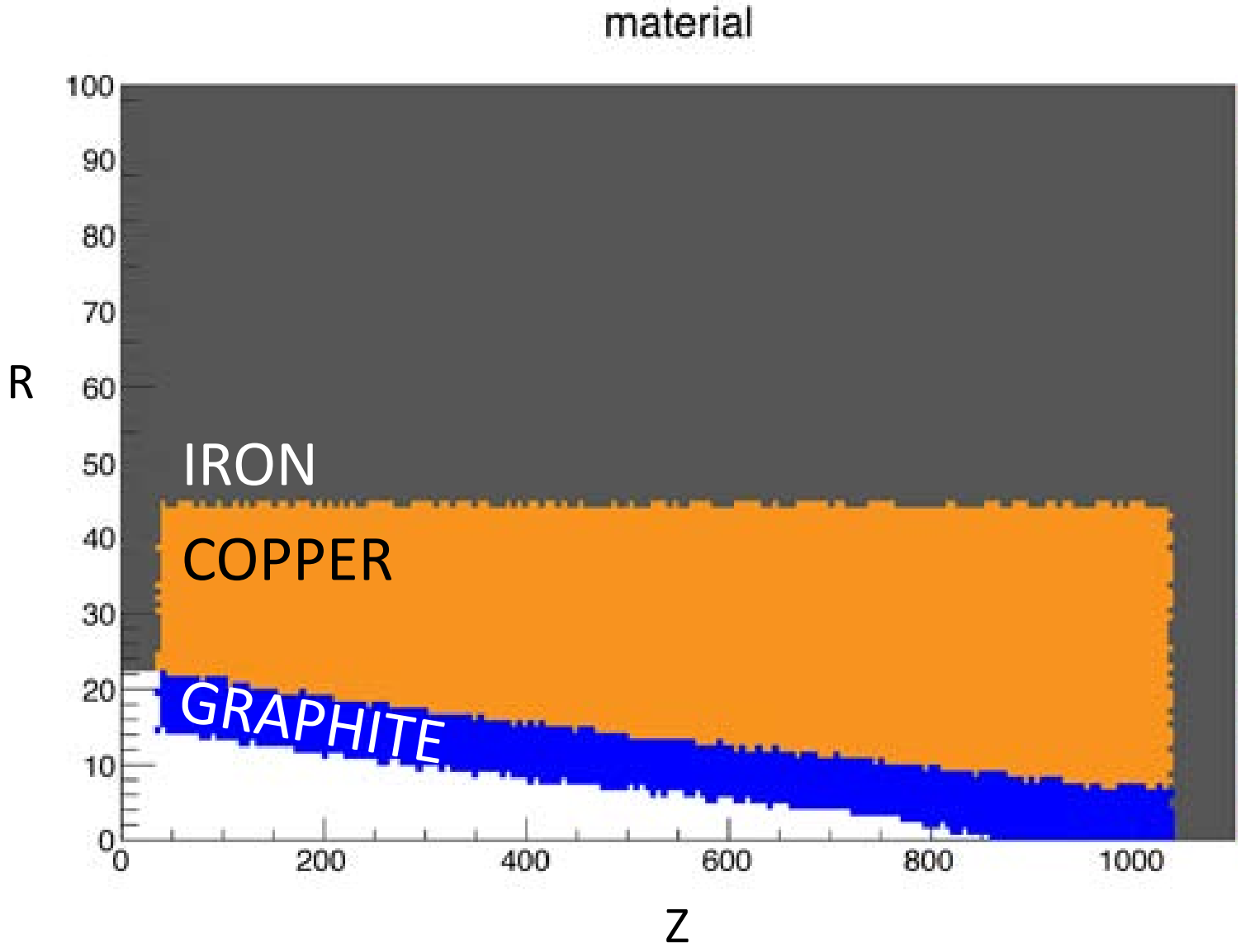


Testing the 6MW Beam Dump



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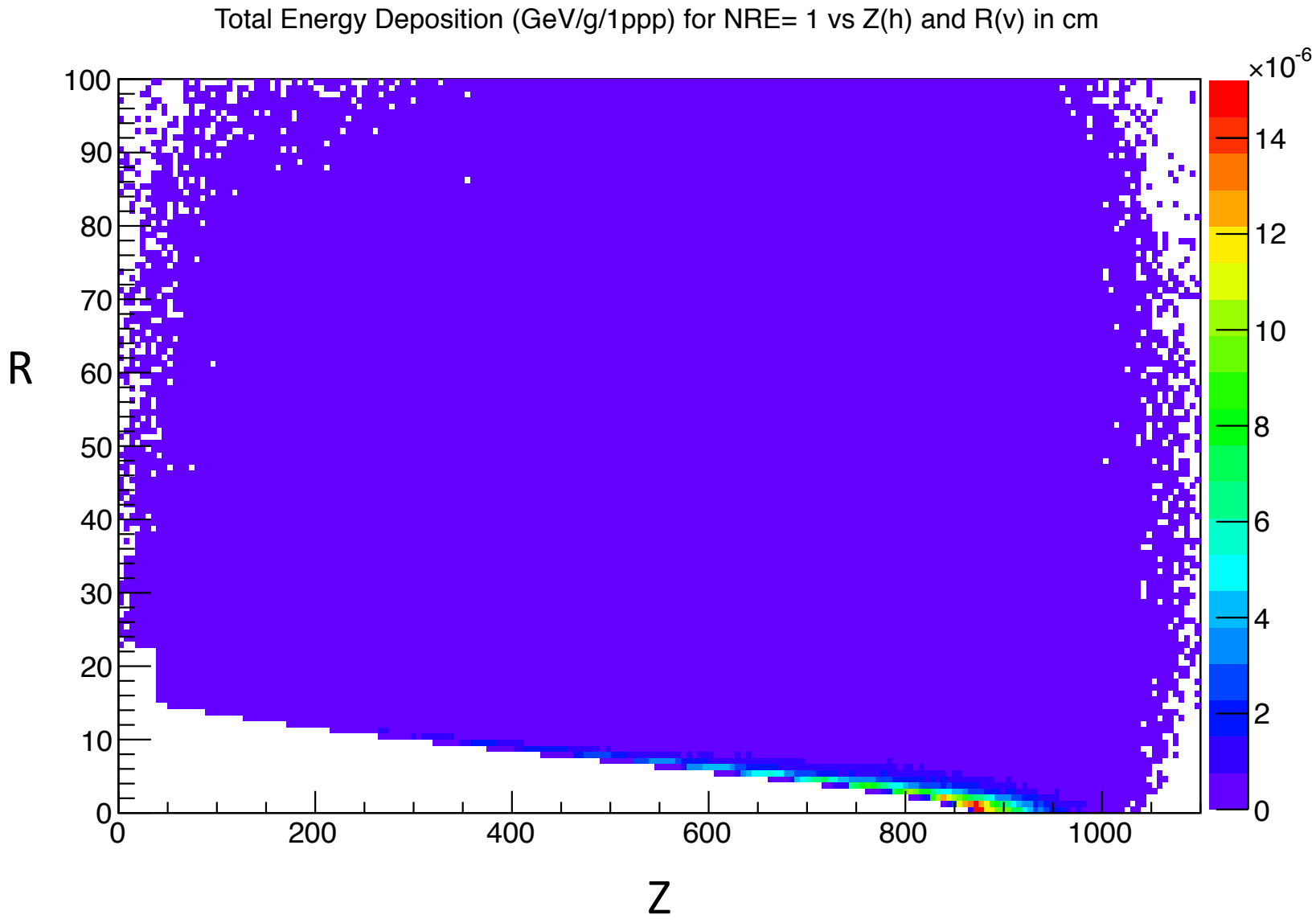

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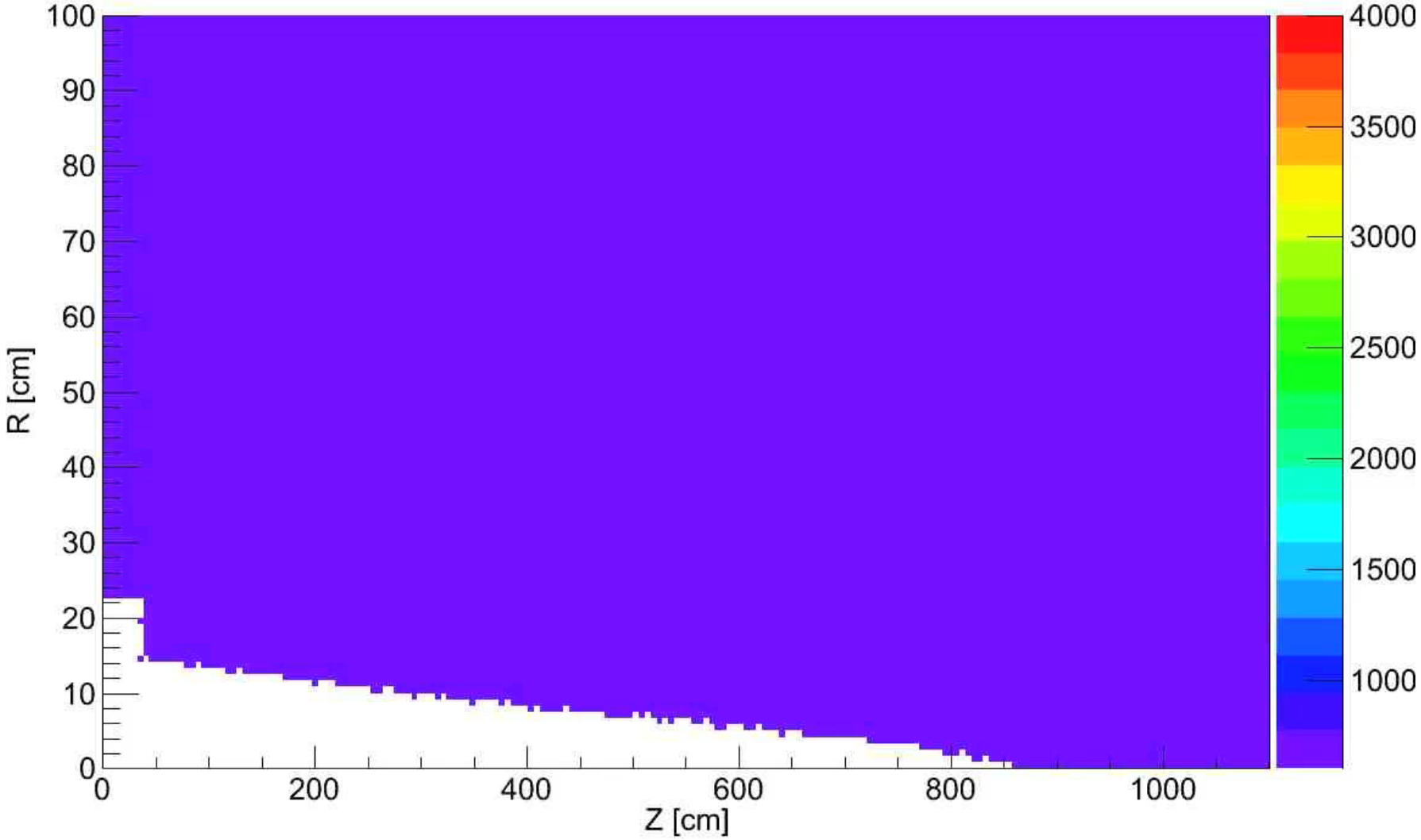

Movie speed 10x(realtime)

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- So far, graphite is melting
- Continuing to tweak geometry
- Next, 1 MW target and Water!

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Thanks!